THE MODEL ENGINEER

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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● WE HAVE not previously illustrated British Railways, Western Region, gas-turbine locomotive No. 18000, designed and built in Switzerland, by Brown-Boveri to the order of the former Great Western Railway. This interesting machine was delivered to this country in February, 1950, and since then it has done good work, in spite of one or two mishaps suffered during the first eighteen months or so of its running. It has run express passenger trains between London and Plymouth and to Bristol, and has shown itself fully master of any demands yet made on it. Although it has run clearance tests on other routes, its running has, so far as we know, been confined to West of England services.

At the moment of writing, No. 18000 has been working, regularly, for many weeks on a somewhat exacting schedule, as follows: 7.30 a.m. from Paddington to Bristol; 12 noon from Bristol to Paddington, with the 9.7 a.m. from Exeter; 6.35 p.m. Paddington to Swindon, returning on the 10.5 p.m. milk train from Swindon, arriving at Southall about 11.40 p.m. and then running light to Old Oak Common depot. This programme has been performed daily almost without a break, and apparently with success.

Our photograph was taken near Twyford, Berks, on a summer day when No. 18000 was working the 14-coach 11.15 a.m. Paddington to Bristol Express; the train was travelling at about 70 m.p.h. One of the noticeable features of No. 18000's running is its almost perfect steadiness, regardless of speed; there is no perceptible swaying, in rather marked contrast to the apparent riding of the following coaches.

Real Gratitude

● OUR NOTE about being at Euston station and watching the "Royal Scot" drawing to a stop exactly on the stroke of time was scarcely in print when we noted the following letter in the *Evening News*:

"On arriving at Euston Station, a small girl insisted on seeing the engine driver. Her words were these: 'Thank you, Mr. Driver, for bringing me up to London quite safe. I have no money; will you please have my Bible?'"

That small girl showed the right spirit, an example to many of her elders; and she probably gave more pleasure than she suspected. After all, enginemen are at least human, and few would fail to be touched by such innocent gratitude.

Of the incident there can be no doubt, because the writer of the letter was Mr. Harold Tootell, of the Motive Power Dept., British Railways, Willesden.

Keighley Exhibition Postponed

● MR. H. BROWNLESS, chairman of the Keighley and District Model Engineering Society, has written to inform us that, due to circumstances quite outside the society's control, the exhibition announced for April 23rd to 26th next has had to be postponed. The society hopes to be able to fix a date during September next, and the new date will be announced when a definite decision has been made.

The "M.E." Queries Service

● SOME OF our readers, noticing the absence of our "Queries and Replies" page in recent issues, have written to ask us whether this service has now been discontinued. We hasten to assure them that this is by no means the case, and that the only reason why we have not published any specimen queries is because the space has been urgently required for material which we believe to be more important. In any case, it should be noted that only a very small proportion of the queries dealt with could be published at any time, as the number received runs into hundreds every week, all of which are replied to by post within a few days, provided that they are accompanied by a stamped addressed envelope. The range of these queries varies widely, in some cases departing from what may be regarded as the legitimate scope of model engineering, but in nearly all cases we are able to give some measure of advice and assistance to querists.

One thing we would ask of readers who wish to avail themselves of this service; that is that they should state their queries in the most concise and exact terms. It is obviously impossible to give accurate advice unless we are fully acquainted with the details of the problem; yet some of the queries are extremely vague, and in a few cases, our most difficult task consists of finding out what they are all about. In the case of electrical queries, in particular those concerning windings, all available data should be supplied. For transformers, the cross-section and length of core, also the "window space" available for windings, should be given. For a.c. motors diameter and length of stator, number of slots and their depth, width of slots top and bottom, and thickness of iron below slots; and for d.c. or universal motors, or dynamos, it is necessary to know diameter and length of armature, number of slots and commutator bars, slot dimensions as specified above, and whether they are straight or skewed; also, position of brushes relative to field poles. A drawing or rubbing of the field and armature laminations is very useful. Reference to maker's names or type numbers is often useless, because we cannot keep records of every make and type of apparatus in existence; this applies also to mechanical appliances, machine tools, etc. In no case can we undertake the valuation of new or second-hand equipment, or the buying or selling of goods on behalf of our readers. But apart from these stipulations, we are ever at the service of our readers to give them all the assistance possible in their practical problems.

"The Live-Steamer"

● WE WERE sorry to see that issue No. 6 of Volume 2 is the last one of *The Live-Steamer* produced by George D. Murray, of Manchester, Conn., U.S.A. This was a bright little magazine, but we learn that unforeseen circumstances have forced its genial editor and producer to cease publication.

From the pages of this now-defunct publication we learnt a lot about the ways of our American friends and their locomotives; there is little doubt that the various meetings for the purpose of exhibiting and running of small locomotives are marked by the same enthusiasm and comradeship that we are used to in Britain. The chief difference, if it can be called a difference, is the great distances which some of the participants will travel to such functions, a three-day journey to the meet being by no means unusual. But it was ever thus, where small steam locomotives are concerned, and we are convinced that it will always be the same; for nothing seems to give quite the same degree of excited satisfaction as does the building, owning and running of a small steam locomotive. The full-size railways may have their electrics, diesels, gas-turbines and other things yet unthought of, but none of these is ever likely to win the same popular approval that the steam locomotive has done. Still more is this so, and likely to remain so, in the case of the steam locomotive in miniature.

We are grateful to Mr. Murray for allowing us to enjoy each issue of his magazine, and we trust that negotiations for its possible future, which we hear are pending, may prove successful.

Supplies of Socket-head Screws

● ARISING OUT of the enquiry from Mr. H. Glyn Jones, in our issue for March 13th, we have received a number of replies from which it is clear that the writers do not quite share Mr. Jones's opinion as to the difficulty of obtaining small quantities of socket-head screws.

Among the firms recommended are: Buck & Ryan, 310-312, Euston Road, London, N.W.1; Woodberry, Chillcot & Co. Ltd., 122, Victoria Street, Bristol; The British Rawhide Belting Co. Ltd., 246, Great Portland Street, London, W.1; Grayson & Co. Ltd., Campo Lane, Sheffield, and S.E.G. Ltd., 7, Spur Road, Isleworth. In every case, it seems that the writers have succeeded in obtaining small quantities; in at least one case only one screw was required and obtained readily.

We are very much obliged to all those readers who responded so promptly and helpfully in this matter.

More Appreciation

● WRITING FROM Auckland, New Zealand, Mr. F. C. King sends us some compliments which are very much appreciated; he says: "May I express my great appreciation of your journal which I have taken for many years. Although I have had more than 40 years' experience of engineering, I still find much to learn in your excellent little paper.

"I must also express my thanks to your contributor 'L.B.S.C.' for his wonderful articles on small locomotives. I have embarked on his latest, *Britannia*, and it is a delight to work to his instructions. I am sending him by sea mail a book on Indian railways which I am sure he will enjoy."

In returning our grateful acknowledgments of these very kind remarks, we offer our best wishes to Mr. King for the successful progress of the construction of his *Britannia*, and we hope that, in due course, he will send us some photographs of her.

little more than a schoolboy, the writer constructed a small model, the piston and cylinder fit of which was certainly superior to that just described but not nearly as good as it should have been.

The details of the big engines were not copied slavishly, far from it, for hardly a single part looked like the part it should have looked like. The engine had the appearance of a collection of odd bits and pieces from the scrap-box—which it certainly was. There is no single piece of it at present in existence.

Now in regard to a suitable boiler to provide steam, I can think of nothing likely to be more successful than the kind of boiler I have now in use in my workshop for giving me a little steam experimentally. It was in early life a good size copper saucepan about $8\frac{1}{2}$ in. diameter by 5 in. deep, but the handle has been removed and it has been copper-bottomed at the open end. It will last a lifetime. The pressure I am accustomed to subject it to will certainly never burst it. It operates upside down, i.e., the copper-bottom referred to above is at the bottom, where I suppose it ought to be.

Now, in the case of a boiler of this description very few fittings are required. They consist in my case of a filler-plug and a safety-valve. The safety-valve blows off at about 10 lb. per sq. in. and the filler-plug does not blow off at all. The boiler may receive a measured quantity of water—using some sort of dipstick—to steam the engine for an hour, or an hour and a half—or any specified time. This will be found an entirely satisfactory procedure.

Well, there is a great deal more to be said about the Newcomen engine—but not here. Any text-book on the steam engine will provide you with all the information you may require—and perhaps a good deal which you may not.

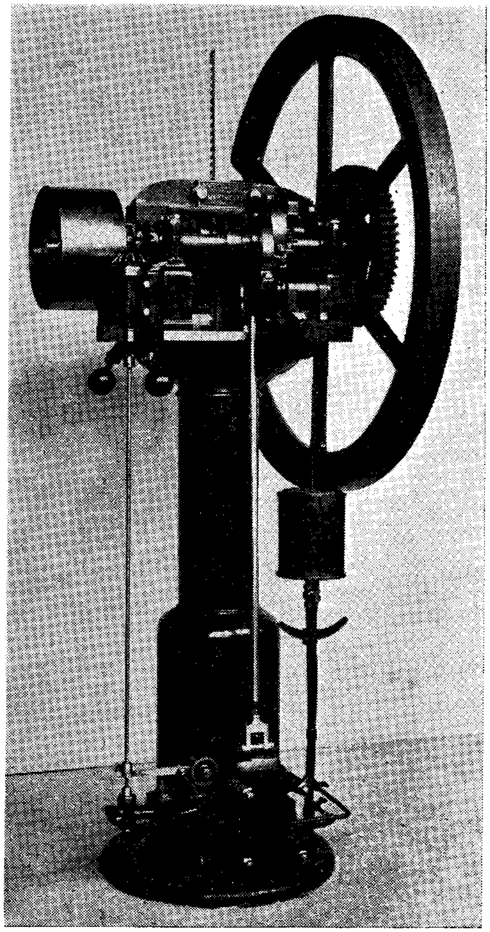


Fig. 1. The Otto and Langen's atmospheric gas engine, showing the rack, slide valve, governor, eccentrics, etc. (Crown Copyright. From an exhibit in the Science Museum, South Kensington

Otto and Langen Atmospheric Engine

And now I must attempt to describe an engine embodying an unusual number of peculiarities. It may be said, without fear of contradiction, that this engine has no crank, nor has it any connecting-rod, but to make up for these serious omissions it has a great number of other moving parts, large and small.

Here then are some of them: a weighty piston with an attached toothed rack, a flywheel and shaft, a "free-wheel" clutch, a slide-valve, a centrifugal governor, a pair of bevel wheels, one or two eccentrics, a ratchet and pawl, several small levers, a pair of spur gears, a catch or two, and among all these multitudinous parts, I can surely have omitted none. Or have I?

Does it not seem strange that whilst so much ingenuity was bestowed upon this engine—invented in 1866—that users of engines had to wait no more than ten years—1876—for the vastly more simple and economical four-cycle engine of Otto.

Now in a few brief words the working principle of this engine may be described. A small upward movement of the piston draws into the cylinder a charge of gas and air, which is almost immediately fired by an external flame, the resulting explosion acts upon the piston with such effect, that it is projected upwards several feet and might indeed even leave the mouth of the cylinder altogether, were it not for a spring-stop arrangement. However, its journey towards the stars having been checked, the cooling of the gases below the piston drags it downwards—the atmosphere again—and provides the rack and clutch system with an opportunity for rotating the flywheel shaft; and of course the flywheel and any attached pulleys. That briefly is the *modus operandi*.

I have grave doubts as to whether this complicated machine could be made to function in a satisfactory manner as a model. Indeed I doubt whether any model maker would care to attempt such a proceeding. It is, however, an atmospheric engine, and therefore no reader will blame me for including it in this article.

Fig. 1 gives an excellent idea of the appearance of this unusual machine, and most of the details

referred to can be picked out. (I suspect that a small piston—say, $1\frac{1}{4}$ in. in diameter—would be found to be uncontrollable and much too lively. One has some experience of small pistons acted upon by explosion pressure.

In the case of a full size engine the conditions are very far from being comparable. The shock and vibration seem from all accounts to have been very formidable. For Dugald Clerk in his excellent treatise on the Gas Engine makes the following remark: "The author has seen an engine at work where the vibration produced was so great that props were put under the engine from floor to floor through four floors to get a solid resistance in the basement."

I do not know when the last of these engines ceased to work, but I would certainly wish to have seen one "in action." A 40 in. stroke is not to be despised and that is the sort of stroke that could be observed at times. With all its complications and peculiarities, the Otto and Langen engine was the most economical gas engine of the period. Of gas, it consumed about 35 cu. ft. per h.p. per hr., which compares rather favourably with another non-compression engine of small dimensions which had a gas consumption of no less than 120 cu. ft. per h.p. per hr. Great heavens, what a gas bill would have been put before the owner of such an engine!

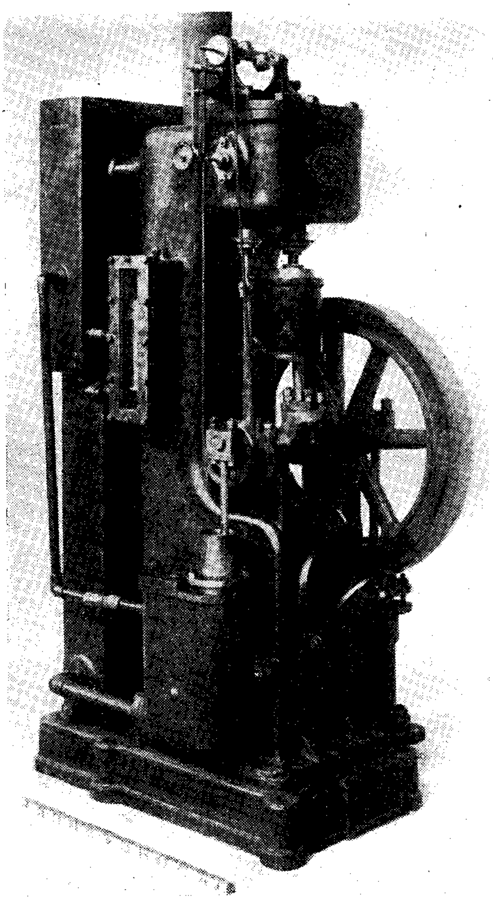


Fig.2. Davey's atmospheric engine (steam), showing cast-iron boiler, condenser, air-pump copper float in glass-covered chamber, etc.

(By courtesy of the Director of the Science Museum, South Kensington)

Davey's Atmospheric Engine

This engine is commonly referred to as "Davey's safety steam motor"—but atmospheric engine it is and I shall so call it. Now this rather peculiar looking machine was invented in the year 1884; i.e., nearly 10 years later than the Otto gas engine. Could it have been intended to compete with the Otto engine? I think not—except perhaps in country districts where gas was not available.

The oil engine, be it said, had not reached a commercial stage. Davey's engine though doubtless *safe* enough, the cast-iron boiler working at atmospheric pressure only, required more attention than did the gas engine—it needed stoking.

Another disadvantage of this engine, and indeed of any solid fuel steam engine, was the need for "getting up steam." Perhaps no more than half an hour would have been spent on this process, still some types of gas engine would have needed half a minute only "to get up steam."

The engine has the appearance of having been built on much too solid lines for the kind of work—domestic—for which it was seemingly intended. There seems to be cast-iron everywhere and little enough attempt to economise this material. Very different was an engine made for a similar purpose and exhibited at the White City in 1908; possessed of a *copper* boiler and I think a cylinder of brass and other parts of similar material. I cannot recall the maker's name and neither do I know if this engine reached a stage of commercial success. And, by the way, reader, if you can perchance look back as far as the year 1908 and recall a few of the interesting engines and machines exhibited at Shepherds Bush, I should feel inclined to consider you fortunate. And now I would refer the reader to Fig. 2 which records all the more important details of this "safety" engine: the open fire-door, the rather heavy flywheel, the cylindrical guide for the crosshead, the somewhat clumsy big-end of the rather short connecting-rod, the eccentric controlling the valve of the engine, the air pump driven from an overhanging pin on the flywheel, the water pump for domestic use driven from the other end of the crankshaft, the rectangular water tank, the centrifugal governor and finally the glass-enclosed copper float to indicate and control water level with certainty and *safety*. I employ the word *safety*, because not very long since I witnessed the breaking of a gauge glass of a locomotive standing at a station platform. I think it was probably a case in which a gauge glass union nut had been carelessly adjusted, but the escaping steam and water spray made quite a demonstration, which quickly drove the fireman from the footplate—the driver had already quitted. In any case, for low pressures, I rather like this copper float idea; it is foolproof and

that, where unskilled people are likely to be concerned, is not to be thought of lightly.

The cylinder is double acting and the surface condenser has vertical tubes, and the valve is driven by an eccentric. I would hardly expect anybody to attempt to make an exact model of this engine as depicted. The general appearance of the engine is unsightly and not at all pleasing. Still, the idea of a vacuum engine working entirely automatically is one which has always appealed to me; but of course on very different lines.

I remember in the dim distant past attempting to apply a surface condenser and air pump to a horizontal engine which was in my possession at the time. The attempt was a complete failure, the vacuum, or part of it, only being retained for a very short time, during which it had sucked pretty well all the steam out of the system. There must be no particle of leakage—of air inwards—which is more difficult to deal with than steam leakage.

Lowne's Atmospheric Engine

The principle embodied in this engine (see Fig. 3), differs from any of those hitherto described inasmuch as the reduction of pressure is brought about by *extinguishing a flame* burning within a cylinder and thus cooling the air contained therein. Unfortunately I have not been able to lay my hands on a fully detailed description of the construction and *modus operandi* of the Hardy and Padmore engine, so I must perforce do a little guessing, and so must you.

It would appear, however, that a valve opens at the upper end of the cylinder, and since there is a bunsen flame burning outside the valve, the down stroke of the piston draws this flame into the cylinder, and this process continues until the end of the stroke when the flame admission valve closes. This results of course in the flame being extinguished and as a result a partial vacuum occurs and the pressure of the atmosphere drives the piston upwards. This seems to constitute the working stroke. There appears to be an extension of the main piston fitted with a somewhat slender crosshead, and this suggests that the engine may be to some extent double-acting. But the slender connecting-rod does not give rise to any thoughts of high pressure. Neither does the crank, which is clearly a casting. One really cannot carry a description much further without a sectional drawing and, as I have said, no such important piece of information is available. So I hope you will forgive me for leaving you somewhat in the dark—as I am.

By the by, Hardy and Padmore, in addition to the Lowne engine, were responsible for a very ingenious little gas engine which was described by Mr. Westbury in THE MODEL ENGINEER, dated March 23rd, 1950. This was *not*, however, an atmospheric engine.

The Lowne engine, owing to its extremely low working pressure, can hardly have been intended to compete with the gas engine. In view of the fact that it must have had a silent exhaust, it is comparable with the hot air engine—which, however, had none. And the hot air engine could be caused to operate as an *atmospheric* engine by getting rid of the *pressure out-stroke* and relying solely upon the in-stroke. I have in some degree tested this on one of my own engines, it was not, however, very successful, probably because I did not carry the scheme far enough. The engine would then become single-acting instead of double-acting—and this would not be advantageous—it would indeed be a retro-grade step.

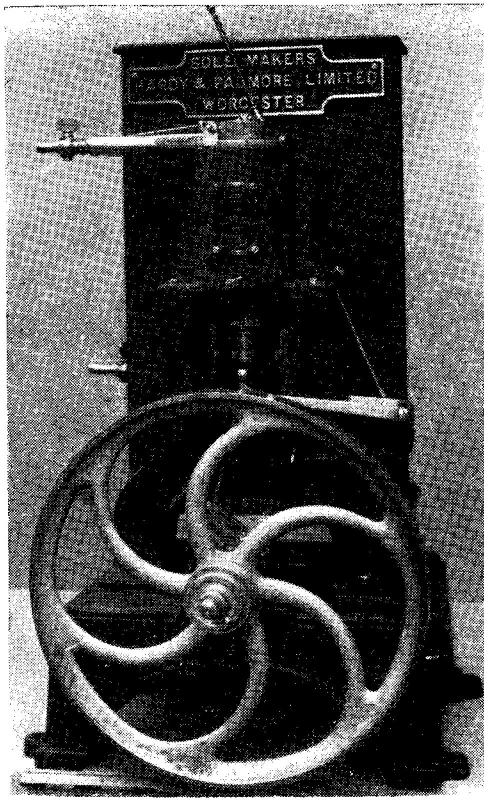


Fig. 3. Lowne's atmospheric engine, showing cooling water tank, bunsen burner, cast-iron cylinder and frame, and light connecting-rod and crank arm. (By courtesy of the Director of the Science Museum, South Kensington)

It may be that I have omitted to mention in this article other engines in which the working stroke was provided by the pressure of the atmosphere only. In this case I fear I shall have to admit that my recollection—usually to be depended upon for matters almost of history—has been a little faulty. Pray forgive me.

At the present time, the atmosphere has not much use, without other help, for imparting motion to a machine, but it serves a very useful purpose of an opposite nature: viz., putting an end to it. For the vacuum brake is in use as much now as in the past and probably more so. And may it not last very many more years until it has finally succeeded in bringing to a standstill every single vehicle running on rails—and a good few that do not. But who can say at what distant date such a state of affairs will come into being?

MODEL CAR RECORDS

Report of the Records Officer, Model Car Association

DURING the past year a total of 32 Record Certificates have been issued, six in the $1\frac{1}{2}$ class, 14 in the $2\frac{1}{2}$ class, six in the 5 class, and six in the 10 class. The charge of 1s. per claim levied has enabled the Records account to be self supporting.

It is interesting to note that, taking the separate classes, the $1\frac{1}{2}$ class has only had $\frac{1}{4}$ and $\frac{1}{2}$ mile records claimed, all longer distances still being unfilled. As might be expected, all the records are the same for both British and Open Categories. Since this is the first year that this class has been recognised, no comparison can be made with previous years.

In the $2\frac{1}{2}$ class, a very notable increase of 12 m.p.h. has been shown on the short distance record, from 72 to 84.11 m.p.h. All records up to 1 mile have been broken, but again the longer distances have not attracted much attention; and British and Open are held by the same cars.

The 5 c.c. class has shown very little increase, a matter of $2\frac{1}{2}$ m.p.h. only, from 96.25 to 98.68 m.p.h. in the shortest distance in the Open Category and no change in the British Category. Records over 1 mile remain as 1950.

In the 10 c.c. Open Class, the 2 shorter distances have been popular, an increase of 12 m.p.h. being shown, from 118.42 to 130.24 m.p.h. The British Category remains as before.

In view of suggestions in the press recently, the disinterestedness in the longer distance is worthy of note. One possible explanation is that the five and ten mile distance is beyond the normal range of "sprint" cars, and really requires a specialised type, designed for the job. In turn, if these were built, they would not be very suitable for normal competition, and few people seem prepared to construct cars specially for record breaking.

To sum up, progress in the $2\frac{1}{2}$ and 10 classes has been quite considerable, but the 5 c.c. and British classes in general rather disappointing. It is hoped that 1952 will see further interest in these directions and more attempts on the neglected longer distances, and in particular, the filling of the gaps where no record exists at all.

A Steam-Driven Outboard Motor

by H. J. Turpin

EVER since the issue of THE MODEL ENGINEER for January 15th, 1950, in which a description of Mr. Caird's petrol outboard motor appeared, I have been toying with the idea of constructing something similar, and just now that idea is halfway to fulfilment. The outboard motor as we know it today is petrol driven, but as petrol engines of any kind make no appeal to me whatever, I was faced with the problem of producing one for steam. It is obvious then that as soon as steam is mentioned the problems of the designer grow more and more.

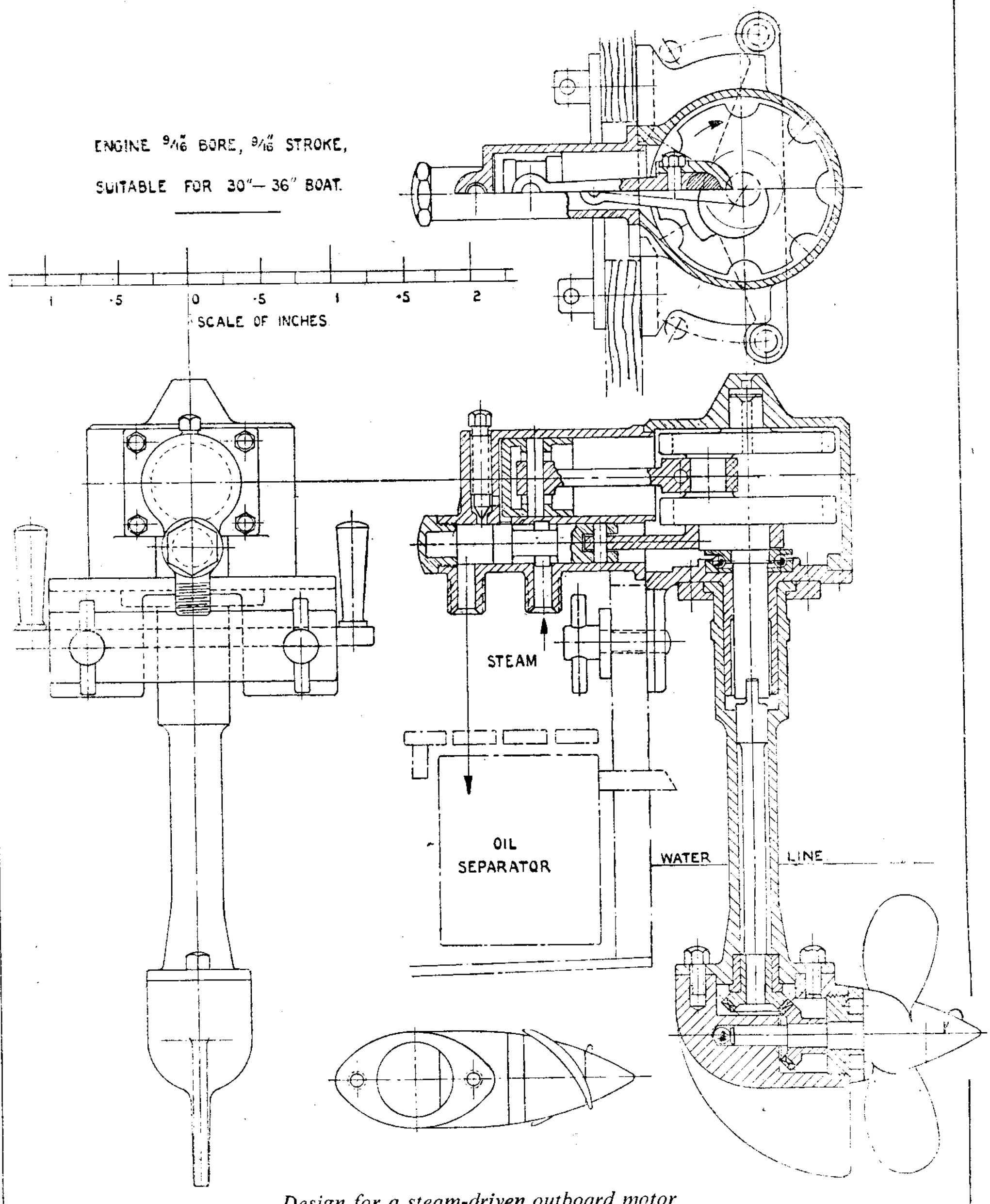
The essence of the petrol outboard motor is that it is a self-contained unit, whereas for steam one needs a steam generator of some kind, the bulk of which one would expect to be two or three times the bulk of the engine. Also, what of water supply? Oil? And the plan in general?

There is no fun in making anything without any problems, and no fun (unless for a special purpose) in copying somebody else. That is why I decided to go for something different. As will be seen from the drawing, the outline generally follows that of the orthodox type, but my greatest problem with the engine was what to do with the exhaust. The whole effect would have been spoiled in allowing partly condensed steam, and oil, to be indiscriminately sprayed into the pond.

At the present time I do not propose to proceed any further than the making of the engine. The general plan, however, is that it could be fitted in a craft up to 3 ft. long, having the rear half of its length an open cockpit with passenger seats around, seaside fashion, while the front half is provided with a cabin into which the boiler unit could be housed. The layout could be made to balance the concentrated weight of the engine on the stern board. Steam would then be led through a lagged pipe under the seats, to the cylinder connection. The exhaust, the outer connection on the cylinder, takes steam straight down into a tank under the rear seat and in which the steam is condensed and oil separated out leaving water only to pass out rearwards just above the water line.

The engine, single-cacting, is $\frac{9}{16}$ in. bore, $\frac{9}{16}$ in. stroke, and is fitted with a piston valve 9/32 in. dia. A compression release-valve, necessary because of the use of a piston valve, is arranged to open into the exhaust pipe *via* the outer end of the valve chamber and made easily accessible from the top. Crankshaft, flywheels and crankpin are in one piece, and, owing to the internal fixing lugs on the casing, scollops are cut in the flywheel rim to facilitate assembly.

The engine and its casing proper are clamped rigidly to the stern board by two self-retaining screws and the steering effected by rotating the down shaft and propeller unit upon a sleeve extension integral with the crankcase flange. This sleeve is split in order to apply rotational friction.



Design for a steam-driven outboard motor

How to achieve satisfactory steering was one of the problems, as obviously the steam connections could not readily be made so flexible as to allow the engine to traverse an appreciable arc. For steering a transverse arm is machined solid with the vertical shaft housing and provided with two vertical handles. The propeller unit is very similar to that of Mr. Caird's design and accommodates a pair of mitre wheels purchased from an "M.E." advertiser, Messrs. Muffetts, of Tunbridge Wells. Lubrication is effected by a hole or lubricator in the top of the casing *via* the top journal, crankpin, and the bottom journals.

The matterials used are stainless-steel and aluminium alloy and should make up into a neat-looking job.

PETROL ENGINE TOPICS

*"New Engines for Old!"

How an Ancient Gas Engine was Improved, Modernised, and Given a New Lease of Life

by Edgar T. Westbury

THE silencer is simply an expansion chamber, having a tangential entry, and a central vertical exit pipe which extends to within a short distance of the bottom. No internal baffles are fitted, and although a slotted diffuser around the bottom of the exit pipe has been tried, it has not been found necessary, the muffling effect being quite adequate without it. In the description of the "Busy Bee" engine silencer, I described the way in which the pressure at the point of exit is reduced by the vortex set up by the tangential entry to the chamber ; this effect may, however, be cancelled out by resonance of the metal shell if this is too thin, or capable of vibration at a frequency in tune with the exhaust noise.

In this particular case, a piece of gunmetal tubing of suitable size was available for making the silencer shell, the top disc, centre tube and entry flange being silver-soldered on, but any material or method of fabrication may be used, so long as precautions against resonance are observed. It is desirable to make the bottom separate, and removable, so that the silencer can be decarbonised when necessary ; some provision for draining it is also desirable, as the products of combustion contain a good deal of H_2O, and when starting from cold, this may build up above the level of the mouth of the exit pipe and cause considerable back pressure. Many cases of mysterious engine stoppage can be traced to water in the silencer, but this trouble is one that can easily be avoided by the provision of a drain plug.

Fuel Tank

When the carburettor is fed by suction, it is very desirable to fit the fuel tank as close as possible to the jet, and also to avoid making it too deep in vertical height, so as to minimise the variation in effort required to lift the fuel as the quantity in the tank varies. In this case, a cylindrical tank, 4 in. diameter by 2½ in. deep, is used, fitted immediately below the jet, and held in place by a single set-screw entering from below the plinth, into a tapped bush sweated in the base of the tank.

The latter is made from 24-gauge sheet copper, the endplates being 4 in. diameter, with rims formed by spinning in the lathe, and the shell rolled up and joined by dovetailing the edges and silver-soldering, in the manner approved by good coppersmiths. It would, of course, be quite appropriate to make the tank of stout tinplate, with a tinsmith's seamed joint, and soft-solder it for a job of this nature, but it was quite a good exercise in sheet metal work, and looked well when finished.

The feed pipe to the carburettor is loose, with a nipple soldered to the top, and a union joint ; it passes through a bush in the top of the tank and extends to within 1/32 in. from the bottom Around this pipe is a cylindrical "stocking" of fine gauze, attached to the bush in the tank at the top, and closed at the bottom, to act as a filter. A large diameter screwed filler cap, with a small vent hole, is fitted to a tapped bush in the tank top, these components all being sweated in before soldering the top in place with a heavy plumber's soldering-bit, the surfaces, of course, having been previously tinned.

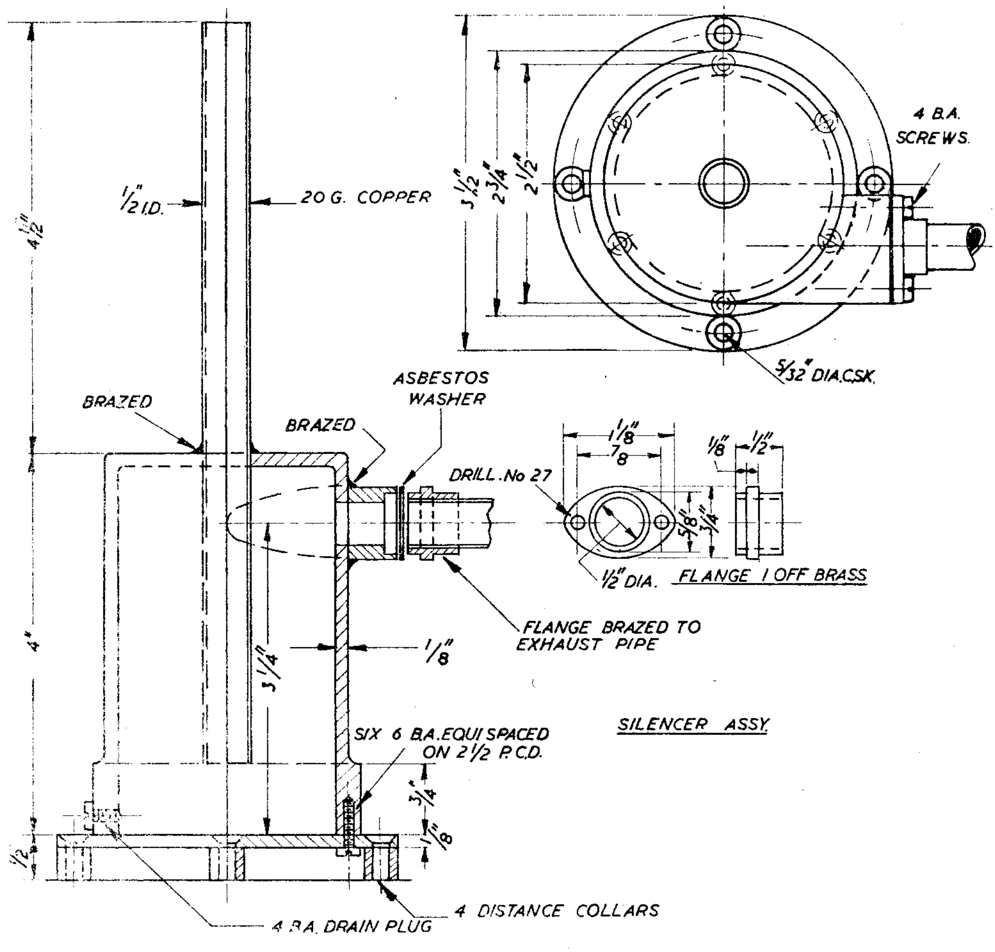
Water-cooling Tank

A rectangular 1-gallon oil can was adapted to form the water tank, the top being cut off and trimmed, and adaptor bushes, screwed and lock-nutted, fitted and sweated in to take the inlet and outlet connections from the jacket, which consisted of short p.v.c. sleeves slipped over the ⅜ in. copper pipes. One reason for using a rectangular tank (a cylindrical one is more common in i.c. engine practice) was in order to enable a belt drive to be taken from the driving pulley, behind the tank, without fouling. This shape of tank also has more radiating surface, in relation to the amount of water it contains, than a round tank ; but most of the cooling effect is obtained from the latent heat of evaporation, in this type of system, and the most efficient form of tank would be one in the shape of a shallow dish, with the maximum area of evaporation surface. However, this does not mean that the tank described is inadequate for its purpose, as no cooling trouble has been encountered on runs of long duration, and it is only necessary to top up the tank about every two hours—which could be done, if need be, by means of a ball-cock, as in a domestic cistern.

The bottom water connection is made in the form of a tee-piece, one of the horizontal limbs being connected to the tank and the other to a drain cock ; the system is emptied when not in use, to avoid corrosion of the jackets and tank. A drain tap is also fitted to the side frame plate to enable the crankpit to be cleared of oil drippings.

**Continued from page* 373, "*M.E.,*" *March* 20, 1952.

Among other details, which have not been dealt with in the articles, may be mentioned the shaping of the edge of the webs on the main casting to improve the appearance, and the fitting of a sheet steel splash guard over the crank. The edges of this are wired to make it as rigid as possible, and it is secured to the casting at each end by two screws. Drip-feed lubricators, of the type used only necessary to close the air shutter till the engine fires. The mode of starting adopted is by pulling on the flywheel rim, and nothing more elaborate has been found necessary. Control is quite good, and a tick-over down to about 100 r.p.m. is possible without readjustment of the jet needle. Ordinary "Pool" petrol gives good results, and experiments with other fuels have not

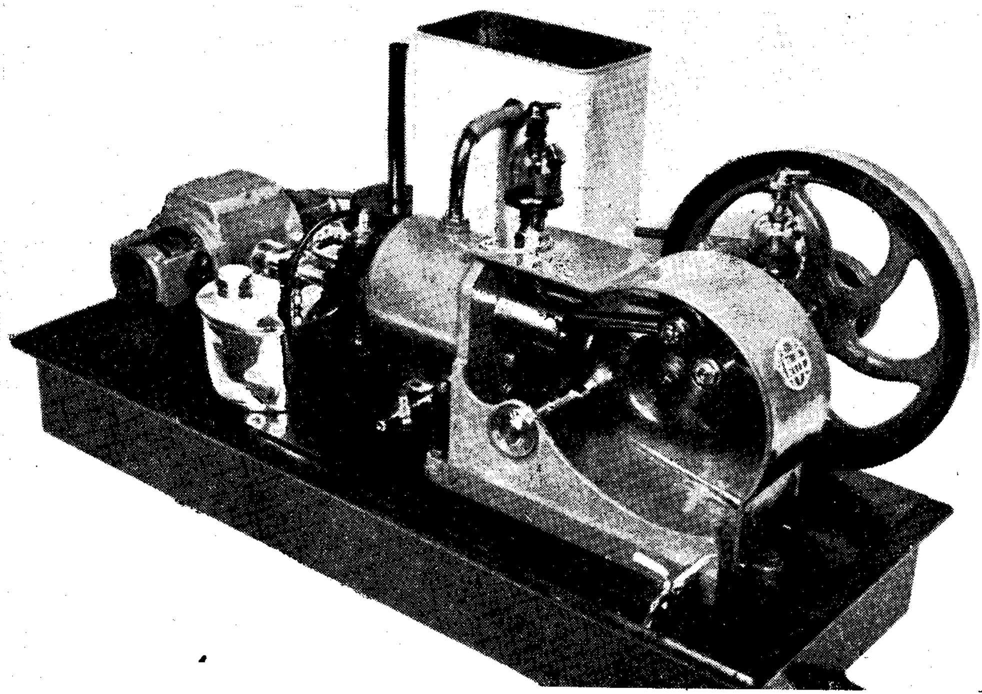


on the M.L.7 lathe, and obligingly supplied by Myfords, are fitted for oiling the main bearing and the cylinder, the latter having a short bent pipe to lead the oil fairly into the hole provided in the cylinder skirt. Note that these two feeds also supply the crankpin and gudgeon-pin, indirectly; the need for continuous feeds on other bearings is not urgent, and an occasional spot from the oil can meets their requirements.

As may be judged from the photographs, the general appearance of the engine is now fairly workmanlike, but what is more important, it works efficiently and behaves as a good engine should. Starting is invariably easy if the correct "drill" is observed; when cold, a spot of petrol injected in the intake is helpful, but if warm it is shown improvement. When running at normal working speed, the mixture strength for a given setting appears fairly constant at any level of fuel in the tank; but tick-over adjustment is more critical, and some readjustment is found necessary when the tank is nearly empty.

At last year's "M.E." Exhibition, the engine did a good deal of running every day, and behaved well, except that as it was at first running light, it had to be throttled down, and a good deal of carbon was formed on the exhaust valve, which thus became leaky and had to be bedded down once or twice to restore compression. Later, a dynamo was fitted, and driven by belt, to give the engine a bit of load, which made it much happier. The dynamo was obtained on the surplus market,

and was of the type having a high- and low-voltage winding. On the former, it was possible to light a 60-watt mains lamp, and on the latter, a 24-watt lamp, the engine being pretty fully loaded, but it should be remarked that the efficiency of these small generators is pretty low—probably not more than 50 per cent. The horse-power of the engine has not been measured, but I am fairly certain by Mr. Amos Barber. Others thought it was driven electrically, using the dynamo as a motor ; while yet others looked for the compressed air line ! There is no doubt that to a generation educated to regard small i.c. engines as the last word in ear-splitting cacophony, the lack of noise from either the exhaust or the mechanical working parts was quite uncanny.



The complete engine installation, including fuel and water tanks, and belt-driven dynamo, on hollow wooden plinth

that it would not be less than $\frac{1}{4}$ h.p. on a continuous run. Such an engine, therefore, could be used to drive a small lathe, or perform other useful functions in the workshop. The comfortable working speed is from about 1,000 to 1,500 r.p.m., at which speed it is quite happy, except that the balance is not all that could be desired, and if it is on a light foundation, a good deal of vibration is set up. This is caused mainly by the flywheel, the casting of which is a good deal out of truth, but up to the present, I have not had time to attend to this. Balancing was not usually considered a matter of first importance by makers of stationary engines, who preferred to rely on a good heavy concrete bed to damp out vibration ; little or no attempt was made to balance some of the horizontal engines I have encountered in the past.

Some of the visitors to the " M.E." Exhibition were very much impressed by the range of control obtained with this engine, and even more so by its quiet running. One very canny Northerner thought he knew the " secret "—it was obviously a " camouflaged " hot-air engine, on the lines of that built and described by " B.C.J.", and later,

Well, readers, I have done my best to show you how this old engine was brought up to date, with emphasis on the principles rather than details, in the hope that both the example and the precept may be found useful to anyone who may essay a similar venture. The methods are applicable not only to one particular type of engine, though the details may have to be varied to a greater or less extent. I have not made any attempt to give working drawings of the complete engine, as suggested by some readers who would like to build one from scratch, because, frankly, if I were building an engine, I should depart considerably from this design, primarily with a view to making the parts much easier to machine with the equipment normally found in the model workshop. It is by no means impossible to design an engine as large as this one, in such a way that all the components can *comfortably* be machined on a lathe of $3\frac{1}{2}$ in. centres. I have already sketched out such a design, and if readers are really interested in building engines which will " earn their keep " by doing useful work, this will be produced in due course.

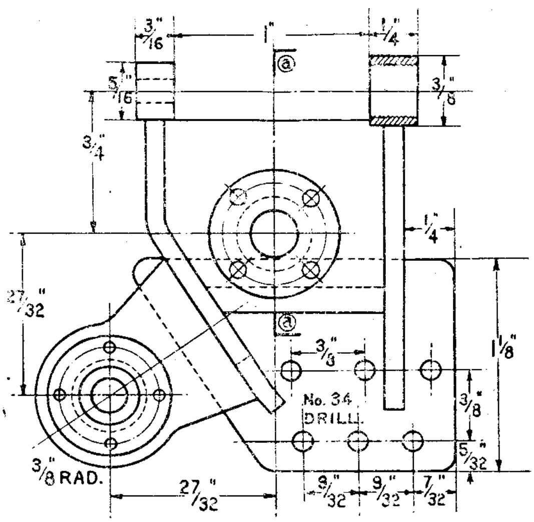
"Britannia" in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

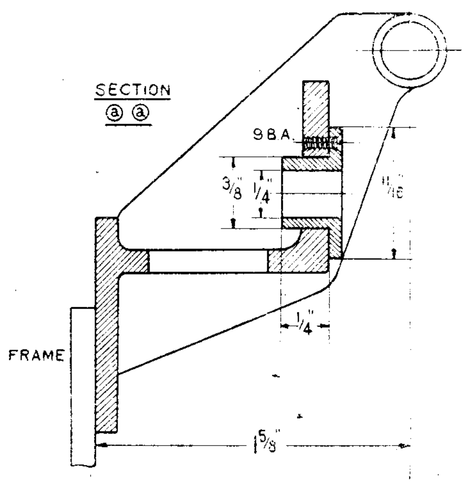
Details of Motion Brackets

SOME time ago, I mentioned that a well-known, but now retired, chief mechanical engineer, when examining some of my handiwork in my own workshop, remarked that to be successful, a small locomotive had to be designed to suit the rail gauge. A reduced copy of a full-sized engine would be useless for real work. As regular followers of these notes know full well, I have preached and practised that doctrine for goodness-knows-how-many years; but I can't recall a more striking example of the truth of it, than the job of adapting some of the *Britannia* components for use on $3\frac{1}{2}$-in. gauge. Not that there is anything wrong with the parts of the full-sized engines; in my humble opinion, they are among the best ever put to work on British metals. Naturally, there have been "teething troubles," but this is nothing fresh in the early days of a new type; and such can be—in fact, they have been—remedied. What I have been up against, is the fact that in full size, there are fabricated parts which are easy enough to make for a 4 ft. $8\frac{1}{2}$ in. gauge job, but either difficult, or even impossible, to make in a similar manner for a $3\frac{1}{2}$-in. gauge engine. For example, the pony truck was a ticklish job to fabricate, so I wangled out a design for a cast one of similar pattern; and our approved advertisers, who did the needful in the way of castings, deserve a pat on the back for their enterprise. Other ticklish bits were similarly disposed of; but when I came to the motion brackets—oh, boy! I thought I'd "had it," as our airman friends would say.

Realising that "the fat would have been in the fire," as my old granny would have remarked, had I substituted simple brackets of my own design for the B.R. patterns, I spread out the drawings of the full-size brackets, kindly supplied by Mr. Riddles, and endeavoured to reconcile them with my $3\frac{1}{2}$-in. gauge chassis. The sheets are literally big enough to paper the walls of my workshop, the general arrangement being half size, and the details full size, for 4 ft. $8\frac{1}{2}$ in. gauge! I also have a close-up photograph of the left-hand bracket, showing the whole bag of tricks, including the expansion link, lifting arms and link, and reversing arm and screw. Well, I got busy on the job; and after a couple of hours at it, I'm telling you right here, that if any of the people we all know, had come in, and as much as breathed the word "scale," there would have been a murder trial at the Old Bailey, with your humble servant as the star turn. I'm also going to say that if the judge and jury had been locomotive builders, and the Q.C.'s had known about locomotives large and small, the verdict would have been "justifiable homicide." Not only that; in addition to being acquitted without



L.H. motion bracket



Section through reverse shaft bush

a stain on my character, even if there were a few on the floor of my "drawing office," I'd probably have received compensation for being put to some needless inconvenience!

Why it Couldn't be Done

Maybe an explanation as to why the full-size brackets couldn't be copied exactly, will be of interest to builders of the little engine, and illustrate what I'm up against, when trying to make the job easy for you all. The right- and left-hand brackets are different, inasmuch as the left-hand one carries the reversing screw. It is built up on a plate which bolts to the frame. Two other plates are welded to this, at right-angles; and the housings for the reversing-screw roller-bearings are welded to the tops of these plates. Just above the bolting plate, the front plate is set in to clear the leading coupled wheel, and has a big slot cut in it, to clear the expansion link as it swings back and forth. On each side of this slot, there is a support welded on, to carry the link trunnion bushes; and these supports are not solid plate, but are built up of two thin plates, box-girder fashion, wider at the back than at the front.

Between the two plates carrying the reversing-screw bearing housings, a vertical plate is welded in, which carries the Bill-Massive-size bush for the end of the weighshaft, or reversing shaft. This in turn is supported by a diagonal plate set on an angle, and extending from the bolting plate to the vertical plate just mentioned. As it joins same above the level of the bush, a whacking great U-shaped piece is cut out of it, to allow the reversing shaft to clear. There is also another staying plate below this, and yet another at the bottom. There is also a gusset welded in, just behind the supports for the expansion link, to resist the bending stresses when the link is waggling back and forth like nobody's business, as the engine proceeds to hit the high spots, to the intense delight of any stop-watch merchants who may be on the train.

"What's wrong with all that?" says our tyro friend. "You just give me the size and shape of the various pieces, and a sketch of how they are assembled, and I'll braze them together, as I haven't any welding blowpipe." Brother, how the merry dickens are you going to hold all the bits of thin plate together while you braze them? On the full-size engine, the plates are of such a size, that *each joint can be welded separately, and won't interfere with the one previously done.* That is the rub! In the small size, the plates are so small, that it would be impossible to weld the joints separately even with an oxy-acetylene blowpipe, let alone try to braze them; and as there is no way of holding the complete assembly together with cramps, as fast as you did one joint, the previous one would come unstuck, and more new words would be added to the dictionary of railroad Esperanto.

The Solution of The Problem

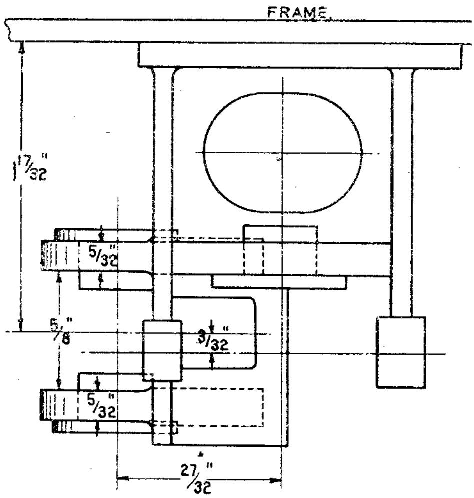
I got over the trouble by calling to my aid, that priceless gift of Nature, the ability to visualise the finished job; and slowly, in my "mind's eye," arose the figure of the bracket which I have drawn out here. At the time of writing, I don't know if our approved advertisers can cast it exactly as I have shown it; the bearings for the reversing screw, for example, may have to be silver-soldered on, but it will be easy enough to fit the link bearings, either plain bushes or ball-bearings as desired, and the bush for the reversing shaft. The whole lot can also be easily erected. Now take a look at the drawings, and see if you can follow this explanation; if you can, the job is easy.

The "foundation" of the bracket is a plate of similar shape and proportioned size to that of the full-sized engine; but being a casting, it naturally has to be thicker. On the outside of this, and at right-angles to it, there are two projections. The lower half of the front one is set back to clear the leading coupled wheel; and on this set-back part, there are two cast-on lugs, of the same shape as the link-trunnion supports on the full-sized engine. The rear projection has only to carry the rear bearing of the reversing screw, and it is made to the shape shown in the illustration showing a vertical section through the centre of the bracket. To serve the double purpose of supporting these two projections, and carrying the bearing for the reversing shaft, they are connected by an angle-shaped web. The horizontal part of it takes the place of the plate struts on the big engine's fabricated bracket, and has a big hole in it, to keep it light and save metal. The vertical part carries the bush for the reverse shaft. Being the world's worst draughtsman, I had plenty of difficulty in drawing out the bracket, so that it could be easily understood; but I guess the four views will do it. The side view, as you would see it on the engine, shows the foundation plate with the holes for the bolts attaching it to the frame; the projections (shown "end-on") carrying the reversing screw bearings; the supports for the expansion link bearings; and last, but not least, the flange of the bush for the reverse shaft. As the whole doings has a family likeness to the welded-up gadget on the big engine, it shouldn't offend Inspector Meticulous.

The end-on view shows the shape of the side projection which carries the supports for the expansion link bearings; you can see the slot for link clearance, between them. The supports are shown in section, giving the alternatives for plain bush bearings, as in full size, or ball bearings, which I am using on my own engine, and which practically eliminate wear, and consequent variation in valve events. The plan view shows the supporting web, with the reversing-shaft bush in place, and the overhang of the reversing-screw bearings; whilst the section through the middle shows how the bush is fixed in the web, and also gives the shape of the rear projection carrying the back bearing for the reversing screw. Note: as mentioned previously, the R.H. and L.H. brackets differ, as the former doesn't have to carry the reversing screw; and to make things as clear as possible, I will give a separate drawing of the right-hand bracket, same as is done in full size, but it will have to wait till the next instalment. "Sufficient for the day is the evil thereof!"

Machining and Fitting Tips

Given a decent casting, there isn't such a wonderful lot to do to it. The vital dimension is the distance from the contact-with-frame side of the bolting plate, to the middle of the lugs supporting the expansion link bearings, which is

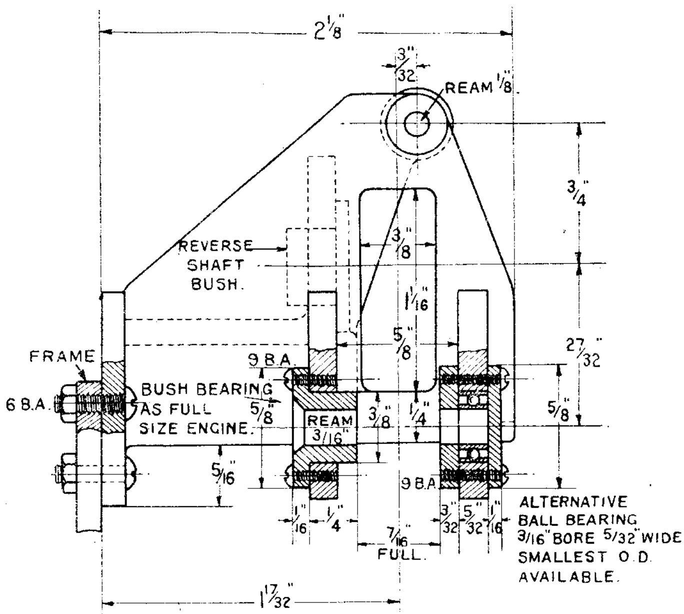


Plan of L.H. motion bracket

1 17/32 in. as shown in the end view, and is proportional to full-size. It is made up thus: $1\frac{1}{8}$ in. from frame to centre of piston-rod, plus $\frac{5}{16}$ in. offset of valve spindle, plus 3/32 in. offset of radius-rod. This tots up to the amount stated; at least, it did in my schooldays, but things have altered so much since then, that I wouldn't swear to it in a court of law at the present time! If a milling machine is available, the contact face can be cleaned up by holding the casting in a machine-vice on the table, and traversing under a small slabbing cutter on the arbor. It could also be held in a machine-vice attached to a vertical slide, and traversed across a fairly big end-mill held in the three-jaw. Readers who have studied the *Tich* notes should be real dabsters at setting up end-milling jobs by now—it only requires common "savvy." However, the humble file, plus a little brains and elbow grease, will do the job quite nicely. Drill six No. 34 bolt holes as shown.

If the casting is reasonably clean, the before-mentioned file will do the needful towards smoothing off the link supports. It is hardly necessary to state that the holes for bushes, or ball bearings, as the case may be, must be absolutely dead in line, and here is an easy way to ensure it. Centre the outer one, and drill it $\frac{3}{16}$ in. either on a drilling machine, or in the lathe, against a drilling pad on the tailstock barrel. Now turn a cone point on a bit of $\frac{3}{16}$-in. silver-steel about 3 in. long, and harden and temper the point. This should be a good sliding fit, without shake, in the drilled hole in the lug. Lay the bracket on its side, poke the punch through the drilled hole, let the point rest on the opposite lug or support, and give the end of the punch a good hefty clout with the tool sometimes known as a "Baernegum screwdriver." Now put the $\frac{3}{16}$-in. drill through the hole, and the point should enter the centre-pop, guiding it truly to start the second hole, so that they can't help being in line. If you are going to use bushes, open up the holes to 23/64 in. and finish with a $\frac{3}{8}$-in. parallel reamer put through both together. If using ball-bearings, same method is used, but the holes should be opened up just big enough to allow the bearings to be pushed in by finger pressure.

I've described how to turn bushes so many times that there is no need to repeat full details; suffice it to say that they should be turned from good-quality drawn or cast bronze rod, to the sizes given in the illustration. Countersink the flanged ends as shown, because they are like that on the big engine, and Inspector Meticulous will raise a loud cheer. Drill them No. 15 for a kick-off; then, when each bush has been placed in its respective hole, and secured by four 9-B.A. roundhead screws, poke a $\frac{3}{16}$-in. parallel reamer through both at once. The

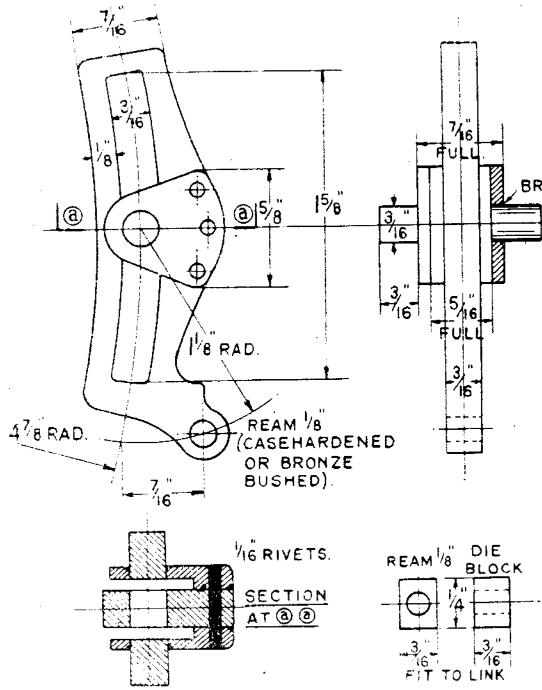


Front end of L.H. motion bracket

links will then oscillate freely, without any tendency either to bind, or wobble about in the wrong direction.

How to Fit Ball Bearings

Ball bearings are retained in place by a washer on each side, as shown. These washers are merely slices parted off a piece of $\frac{5}{8}$ in. round rod held in three-jaw. The inner ones are 3/32 in. thick, with a $\frac{3}{16}$-in. hole in the middle ; the outer ones are $\frac{1}{16}$ in. thick and have no hole. When



Details of expansion link

erecting, put a piece of $\frac{3}{16}$-in. round silver-steel through the hole in the ball bearing, and put the washer over it on the inside of the lug ; this will locate it correctly. Then put the outer washer in place ; this should have the four centre-pops on it for the screwholes, or better still, have the four holes ready drilled, using No. 53 drill. Hold the washers in place with a tool-maker's cramp over the lot, and drill through both washers and lug. Open the holes in the solid washer and lug with No. 48 drill, tap those in the holed washer with 9-B.A. tap, and erect temporarily with a couple of screws in each, to hold them until the expansion links are ready.

Incidentally, it is a million dollars to a pinch of snuff, that somebody or other will raise a moan because, with the above arrangement, 3/32 in. of the link trunnion at each side will be in the hole in the washer, instead of being entirely in the ball-bearing. This doesn't matter a Continental, as the bearing will take the strain ; but even that "difficulty"—save the mark !—can be got over, by making the hole in the washer big enough to take the full diameter of the bearing. This will allow it to go close up to the trunnion blocks on the link. The retaining washer on the outside will then need a spigot on it, 3/32 in. deep, to enter the hole in the lug, and keep the ball-bearing from coming away from the link.

Reverse Shaft Bushes

In case any inexperienced worker wonders how on earth he is going to locate the hole for the reverse shaft correctly, here is the easy way. Hold the bracket in a machine-vice by the projecting part of the back flange at the right side, with the expansion link supports pointing upwards, and stand it on the lathe bed or drilling-machine table. Adjust with try-square, stock on table, and blade to the side of flange. Set a scribing block with the needle level with centre of link trunnion bush. Move scribing block away, stand a steel rule on end beside it, and drop the needle point 27/32 in. below its original setting. With this new setting scribe a line on the vertical face of the web. Now turn the bracket right way up in the machine-vice, setting truly with try-square as before. Set the scribing-block needle again to the centre of link trunnion hole, and this time *raise* it 27/32 in, by aid of the rule. With this setting, scribe a line intersecting the first one. At the "level crossing," make a centre-pop, drill and ream to $\frac{1}{8}$ in., make and fit the bush exactly as you fitted the bushes for the expansion link trunnions, and Bob's your uncle once more. The bearings for the reversing screw can be left until the screw is made, and it can then be fitted right away.

New "Eclipse" Pad Handle

We have recently received from Messrs. James Neill & Co. (Sheffield) Ltd., manufacturers of the famous "Eclipse" engineers' supplies, details of their latest redesigned and improved pad handle.

The new handle is moulded from a tough and durable plastic material, lighter in weight and more comfortable to the touch than the metal used previously.

This tool is specially designed for short-stroke sawing in awkward positions where a hacksaw would be useless, and is supplied, complete with a short hacksaw blade, by most tool stockists and ironmongers. In the event of difficulty, write to James Neill & Co. (Sheffield) Ltd., Composite Steel Works, Napier Street, Sheffield, 11.

IN THE WORKSHOP

by "Duplex"

No. 112.—The Lever Feed Tailstock

THE lever feed tailstock, sometimes called a handlever tailstock, is a device that enables drilling, reaming, counterboring, tapping and threading to be carried out quickly in the lathe.

As the name given to the attachment implies, the tailstock barrel is fed forwards by means of a lever instead of by the usual handwheel.

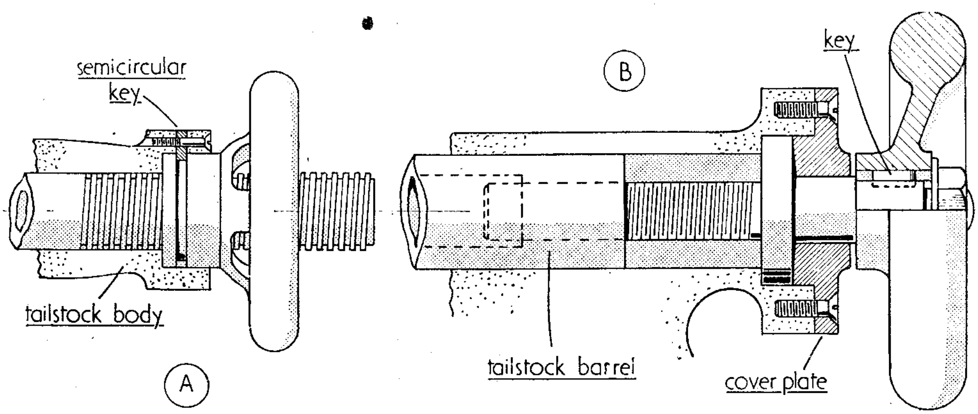


Fig. 1. (A)—Methods of tailstock operation. Barrel threaded externally ; (B)—Methods of tailstock operation. Barrel threaded internally

The lathe user has, therefore, very sensitive control over operations such as drilling ; moreover, withdrawal of the drill is almost instantaneous, so that, when drilling a deep hole, the speed of penetration is rapid because the chips can be cleared quickly.

The device is, therefore, analogous to a sensitive drilling machine but, in this instance, the drill is not rotating. With suitable equipment, such as a small turret, it is possible to make use of a lever feed tailstock for the small quantity production of parts that need no very great accuracy.

This is an aspect that will appeal to those who run small commercial machine shops, but the ability to drill rapidly when using a tailstock fitted with lever feed is the application that has the more general interest.

Commercial Attachments and Devices

In the commercial field, two distinct types of device are obtainable. The first pattern for use with tailstocks having the working thread formed upon the outside of the barrel. The second pattern, to be employed with tailstocks that have the working thread formed within the barrel. These two differing arrangements are illustrated in Fig. 1A and Fig. 1B respectively, where it will be seen that, whereas the first pattern of tailstock had a handwheel bearing directly upon the tailstock barrel, as in the Myford ML7 and Drummond lathes, for example, the second type of tailstock employs a threaded spindle to engage the working thread. The operating handwheel is then mounted upon the end of this spindle. It will also be observed that the handwheel illustrated in Fig. 1A is retained in place by a key that fits into a slot formed on the hub of the wheel and in a corresponding key-seat formed in the casting of the headstock itself. In this way axial movement of the handwheel is prevented. Thus, when the wheel is turned, the tailstock barrel only will move endwise.

In the illustration (Fig. 1B) the tailstock feedscrew will be seen to be provided with a collar formed integrally with the screw itself. This collar fits into a recess machined in the tailstock casting and all endwise movement of the feedscrew is prevented by the coverplate. This plate, which is furnished with a spigot to register with the recess in the tailstock casting, also serves as a bearing for the spindle.

Simplest to Convert

When the necessity occurs for adapting either of these arrangements to lever feed, the pattern illustrated in Fig. 1A is clearly the simplest to convert. Once the key has been removed and the handwheel withdrawn, the tailstock barrel is left free to move endwise when operated by a suitably mounted hand lever. The method

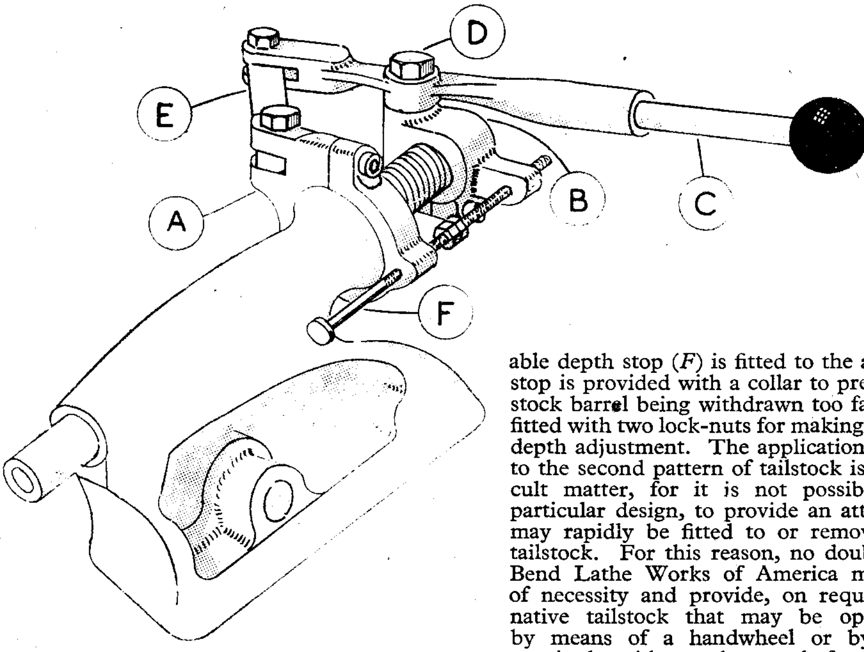


Fig. 2. Myford lever-operated tailstock for M.L.7 lathe

employed by the Myford Engineering Co. on their M.L.7 lathe is illustrated in Fig. 2. This device consists of a bracket (*A*) to clamp on the machined end of the tailstock casting, a threaded adapter (*B*) to engage the tailstock barrel, and an operating lever (*C*). The threaded adapter is provided with a shouldered hexagon screw (*D*) and the operating lever swings upon it. A swinging link (*E*) engages both the end of this lever and the bracket (*A*). In addition, an adjustable depth stop (*F*) is fitted to the adapter. The stop is provided with a collar to prevent the tailstock barrel being withdrawn too far, and is also fitted with two lock-nuts for making the necessary depth adjustment. The application of lever feed to the second pattern of tailstock is a more difficult matter, for it is not possible, with this particular design, to provide an attachment that may rapidly be fitted to or removed from the tailstock. For this reason, no doubt, the South Bend Lathe Works of America make a virtue of necessity and provide, on request, an alternative tailstock that may be operated either by means of a handwheel or by a lever as required, without the need for the removal of any parts or the fitting of supplementary components.

The South Bend handlever tailstock is illustrated in Fig. 3.

Handlever Attachments that may be Constructed in the Small Workshop

(1) *Attachment for use with tailstocks having exterior working thread.*

The device illustrated in Fig. 4A and B was devised many years ago for attachment to a $3\frac{1}{8}$ in. centres Winfield lathe and has the merit that, in common with the South Bend handlever

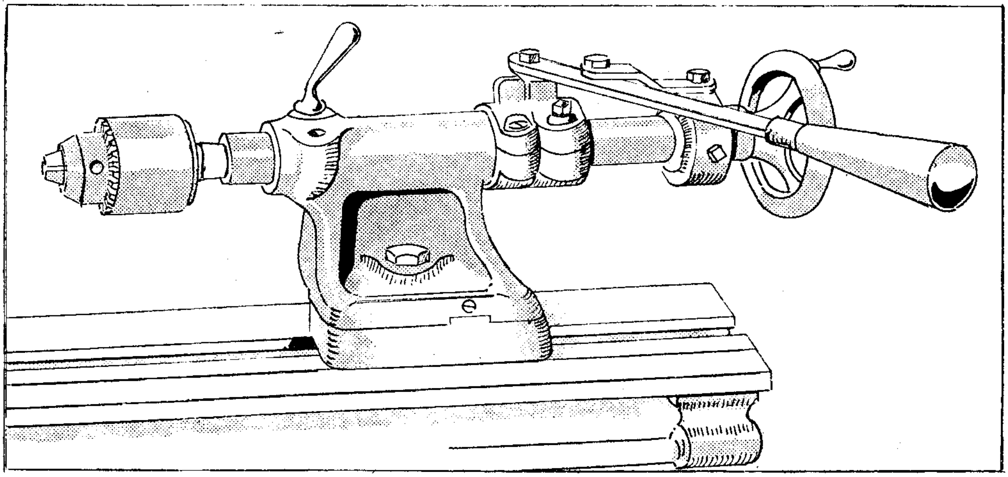


Fig. 3. South Bend handlever tailstock

tailstock, it enables either the handwheel or the lever to be used at will for controlling the tailstock barrels. The attachment was described in THE MODEL ENGINEER ten years ago. In response to many requests, however, the device is now being described again, together with such modifications as have been made to it. In case some may suggest that this device bears a marked similarity to the Myford M.L.7 attachment, it should perhaps be mentioned that it was from the attachment illustrated that the Myford Engineering Co. drew their inspiration. Much use of the device during the past ten years has suggested that a few small modifications would improve the design and also simplify construction. These alterations have been embodied in the working drawings, but are not all to be seen in the illustrations of the assembled attachment.

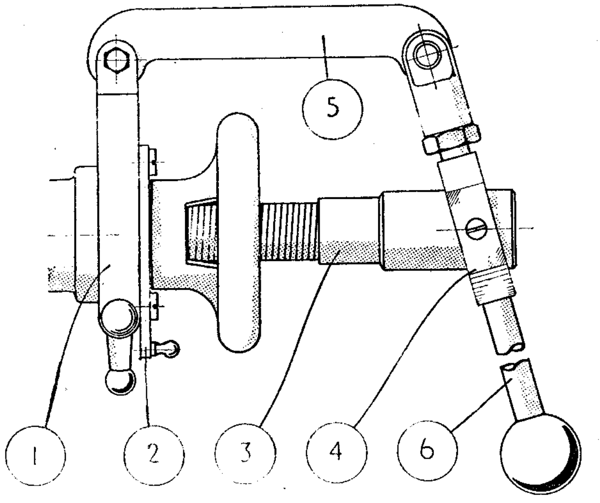
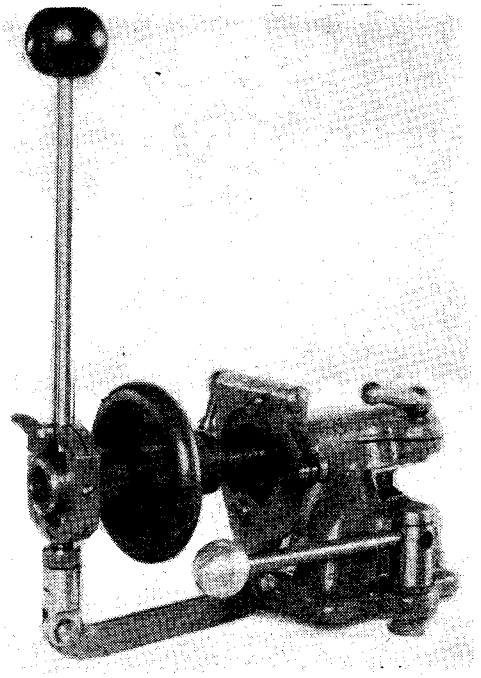


Fig. 5. General arrangement of the lever feed tailstock

Components

The various parts of the device are illustrated in the general arrangement drawing (Fig. 5) and in the photograph (Fig. 6). It will be seen that the difference between this attachment and the equipment made by the Myford Engineering Co. for the M.L.7 lathe lies in the provision of a swinging latch to engage the circular slot in the handwheel hub. This provision allows the wheel to remain in position on the tailstock barrel but to be prevented from endwise movement or allowed to move axially simply by throwing the latch in and out of engagement. In this way the device is ready for instant use either as a normal handwheel-operated tailstock or as a lever-controlled unit.

The attachment consists of a clamp (1) securing



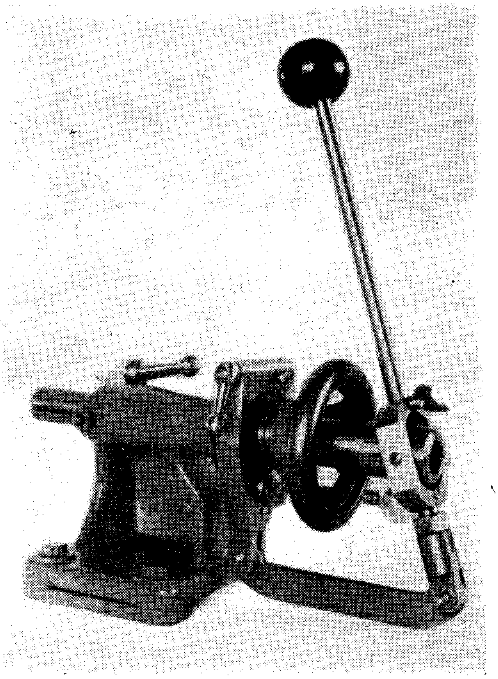


Fig. 4. " A " and " B." Lever feed tailstock for the Winfield lathe

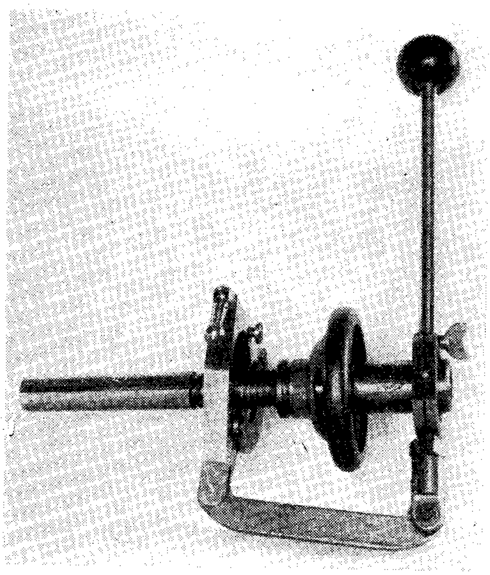


Fig. 6. The parts of the lever feed tailstock

the whole device to the tailstock casting. This clamp is provided with a latch (2) to engage the handwheel when it is necessary to use the tailstock the normal way. An adapter (3) is screwed to the end of the tailstock barrel and carries two segments to receive the hinge pins of the bridle (4). The bridle itself is fitted with an adapter for the detachable handle and also with a fork to accommodate the link (5) connecting the bridle to the clamp. The detachable handle (6) is made so that it may be quickly removed for safety.

The attachment may be unclamped and swung round the axis of the tailstock by undoing the ball-ended lever seen on the underside of the clamp. This allows the handle to be brought into the most comfortable position for working.

Making the Lever Feed Attachment

Examination of the detail drawings (Fig. 9) to appear in the next article, will show that there is little difficulty in making the various parts. The machining of the seating for the clamp (1) on the tailstock casting, on the other hand, does pose a small problem, particularly when the machining must be carried out on the lathe to which the tailstock belongs. In this instance a special boring bar must be made and inserted through the bore of the casting, as illustrated in Fig. 7. The boring bar is mounted in the four-jaw independent chuck and is set to run truly ; the other end of the bar is supported by a steady. The work is fed towards the tool by means of the lathe saddle. In order to do this the saddle is first brought into contact with the casting ; the saddle automatic traverse is then engaged and the casting is thus pushed along the bed of the lathe towards the tool mounted in the boring bar. In carrying out this operation it is advisable to strap the saddle and the tailstock casting together, though this procedure is not essential. The depth of cut should not be too great. It is better to carry out the machining in easy stages, taking light cuts.

If a large lathe is available, the machining of the casting is readily carried out by mounting the work on a mandrel held in the chuck and supported by the tailstock. The turning operation is, then, carried out at a slow speed using a right-hand knife tool. After the casting has been machined, a start can be made with forming the Clamp Part No. 1.

(To be continued)

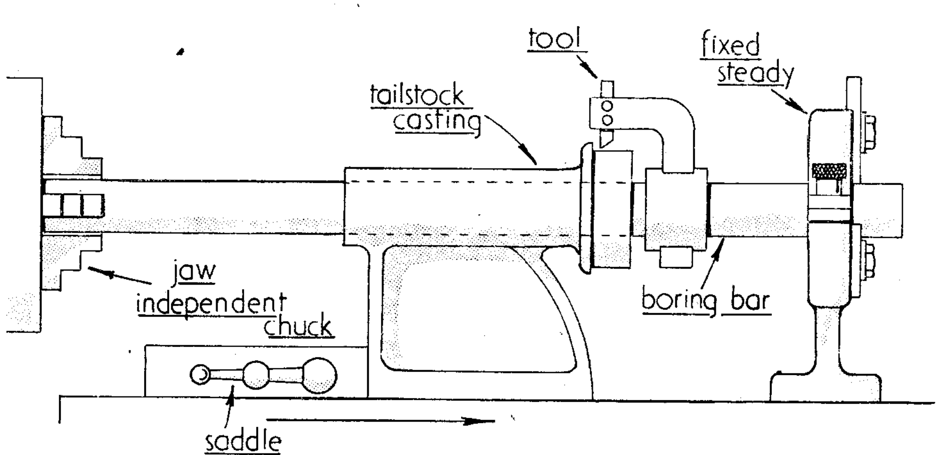


Fig. 7. Machining the tailstock casting

Two Fine 1-in. Scale Locomotives

by "Hallam"

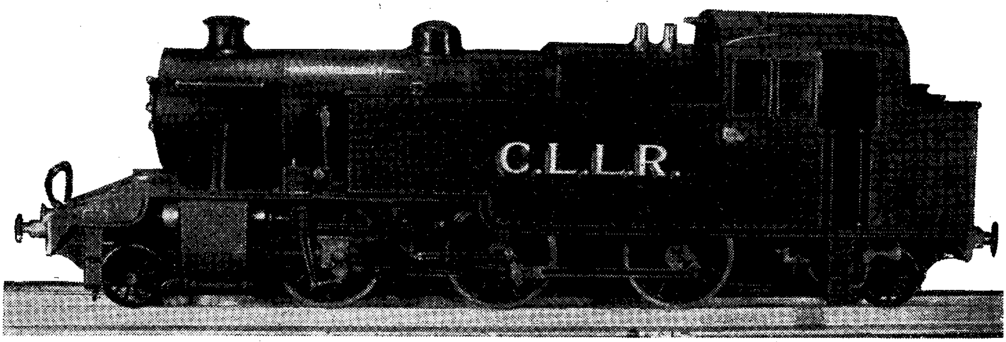


Photo by] [*H. V. Garside*

"*Atlas*," *a 1-in. scale 2-6-2 locomotive built by Mr. R. Kerry, of the Sheffield and District S.M.E.E. This photograph was taken some years ago: she now wears name-plates on the side-tanks above the initials of her parent track*

SOME seventeen or eighteen years ago, when the Sheffield and District S.M.E.E. was being formed, one of the founder-members was Mr. Reg Kerry, and ever since that time he has been noted for the amount of hard work he has put in on behalf of the society. Although his business unfortunately precludes him from attending many ordinary meetings, he is always to the fore at exhibition time, and as a member of the council of the society his shrewdness and common sense play no small part in its affairs.

A Follower of "L.B.S.C."

As a keen locomotive fan, Mr. Kerry follows "L.B.S.C's." notes closely, and he affirms stoutly, and with reason, that *anyone* can build a real passenger-hauler if he will follow the "words and music." There is no doubt, of course, that very many small locomotives have been built, which never would have been built were it not for "the maestro," and since Mr. Kerry has had no engineering training whatever, he feels that, like many others, he owes a debt of gratitude to the originator of the live steam notes.

Another person to whom he is grateful for guidance and advice (especially in his early model engineering period) is Mr. A. C. Harrison, also a founder-member, and incidentally first secretary, of the Sheffield club. But, as Mr. Kerry remarks, the best teacher of all for the tyro is workshop experience! "Get on and get it done; if it isn't right make another," is his motto, and he contends that many people waste much time in studying out a detail, which could be spent more profitably and practically in actual work! Here, no doubt, some readers will disagree, but this scheme undoubtedly pays dividends in Mr. Kerry's case

An Inch-scale Passenger-Hauler

Way back in 1938, on May 19th to be precise, "L.B.S.C." described how to "double-up" his famous *Dyak* design, which was for 2½-in. gauge, of course, to make an inch-scale engine. (This was in response to Mr. R. Stamp, then chairman of the Sheffield club.) At the time Mr. Kerry was building *Maisie* to ¾-in. scale, but the idea was carefully pigeon-holed in his mind.

In due course, out came the issues dealing with *Dyak*, and with the "doubling-up," and work began on a tank-engine based on her. As will be remembered, *Dyak* is a 2-6-0, and for the tank locomotive the frames were extended rearwards to take a trailing pony-truck. The only other alteration was to make the gauge 4¾ in. instead of 5 in., this being the correct gauge for the scale, and the one to which all inch-scale locomotives should be built, in the Sheffield view.

The locomotive is shown in the first photo, and there is not much point in describing her in detail, since she does follow "L.B.S.C.'s" words and music. There were no snags, and the engine was finished in two years.

Since then she has earned a great deal of money on the track, running at the Sheffield exhibitions, and at those of other societies, as well as at galas and fetes for various charities. This was Mr. Kerry's idea when contemplating her construction, to have a locomotive which would run reliably on the track, for long periods if necessary, and which would haul a good load. Incidentally, the size of the firebox ensures that steam can be kept up easily, without too frequent firing.

The longest period in steam to date has been eight hours, but here the fire was dropped

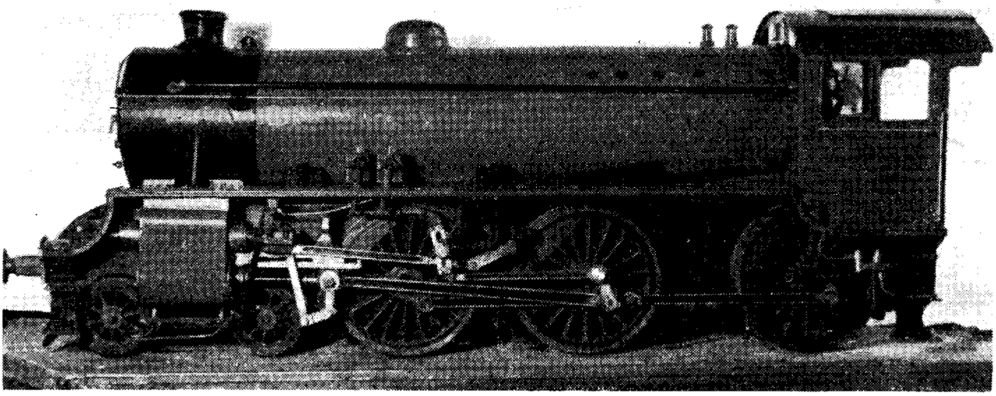


Photo by] [*The Author*
A 1-*in. scale L.N.E.R. Class B.*1 *locomotive built by Mr. Kerry. It is hoped to complete the engine and tender this summer*

halfway and a new one built—having raised a full head of steam first, of course. The engine is equipped with two axle-driven pumps and an injector for boiler-feeding, by the way, with an emergency hand-pump in the rear tank.

Since the locomotive was completed, now more than five years ago, she must have run many hundreds of actual miles, but the cylinder-heads have never been off and the boiler has never been emptied. However, the builder is now going to strip her down completely and get her in tip-top fettle ready for the 1952 Sheffield exhibition, which is planned for August.

An L.N.E.R. Class B.1. Locomotive

When the tank-engine was finished, Mr. Kerry decided that he would build an L.N.E.R. "B.1." next, and make her to scale as near as possible. The engine herself is now nearing completion, and locomotive experts will be able to decide for themselves whether or not this ambition has really been successfully achieved.

As a matter of fact, the locomotive is being built from "official" drawings, which were acquired by Mr. Kerry in an unusual manner. It isn't often that a "complete railway" is taken lock, stock, and barrel to a full-sized locomotive works, but the Doncaster Works of the L.N.E.R. were having a gala a few years ago, and borrowed the Sheffield society's portable track. Mr. Kerry was running his tank-engine that afternoon, and having dropped a suggestion in the appropriate quarter, was rewarded a few days later by the arrival of the necessary drawings. Truly one good turn deserves another!

The boiler contains four $\frac{3}{4}$-in. superheater flues, and eighteen $\frac{7}{16}$-in. tubes. The working pressure is 80 to 85 p.s.i., and "live steam" principles have governed the design. This may also be said of the cylinders, which are $1\frac{1}{2}$-in. bore and $2\frac{1}{4}$-in. stroke, and of the valve-gear.

It will be noticed that there are two working

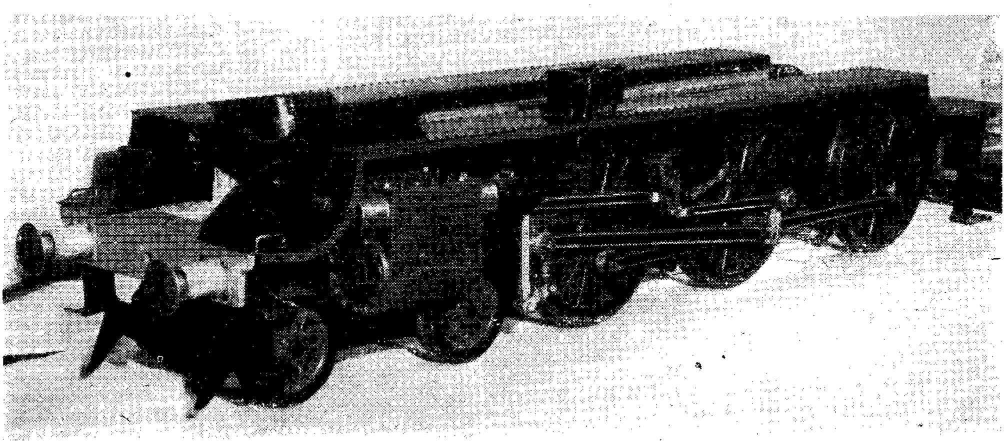


Photo by] [*Press Photo Agency, Sheffield*
The chassis of "*B.*1," *as exhibited at the Sheffield Exhibition in* 1950

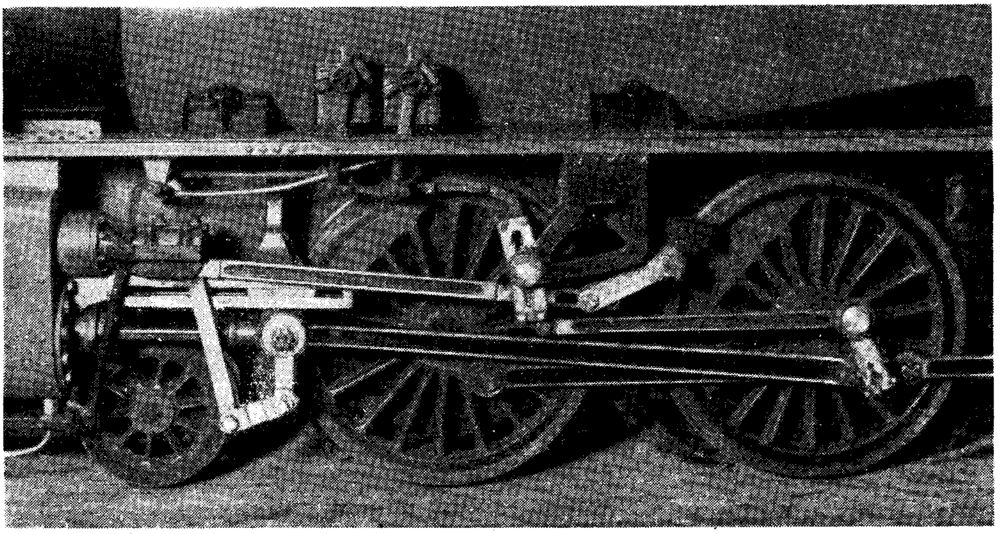


Photo by] [*The Author*

"*Close-up*" *of the valve-gear of the B.*1

mechanical lubricators. Working steam brakes are fitted, and the snifting-valve, behind the chimney, also works correctly. As with the tank-engine, *Atlas*, there are two axle-driven pumps and an injector for boiler feeding.

All the patterns, including those for the wheels, were made by the builder, and castings were obtained from a local foundry—the same applies to *Atlas*, by the way.

For the time being, work has stopped on B.1, because of the overhaul of the other engine, but she has passed her steam test satisfactorily, though not on the track. The tender is well under way, and the builder hopes to have the locomotive and tender completed and running at the exhibition, time permitting. The length over all, by the by, will be 5 ft. 3 in.—quite a bit of locomotive!

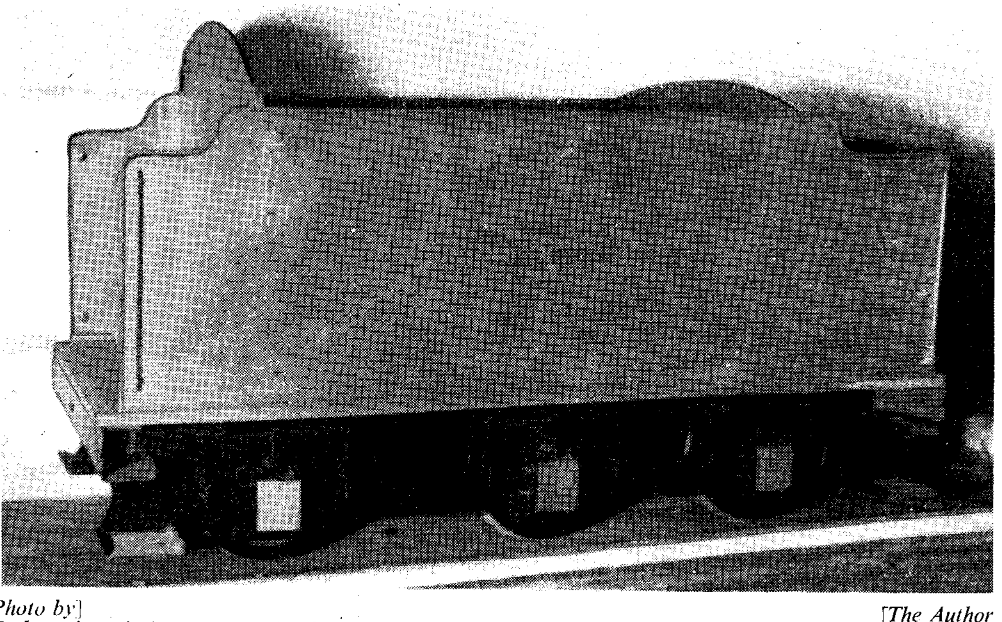
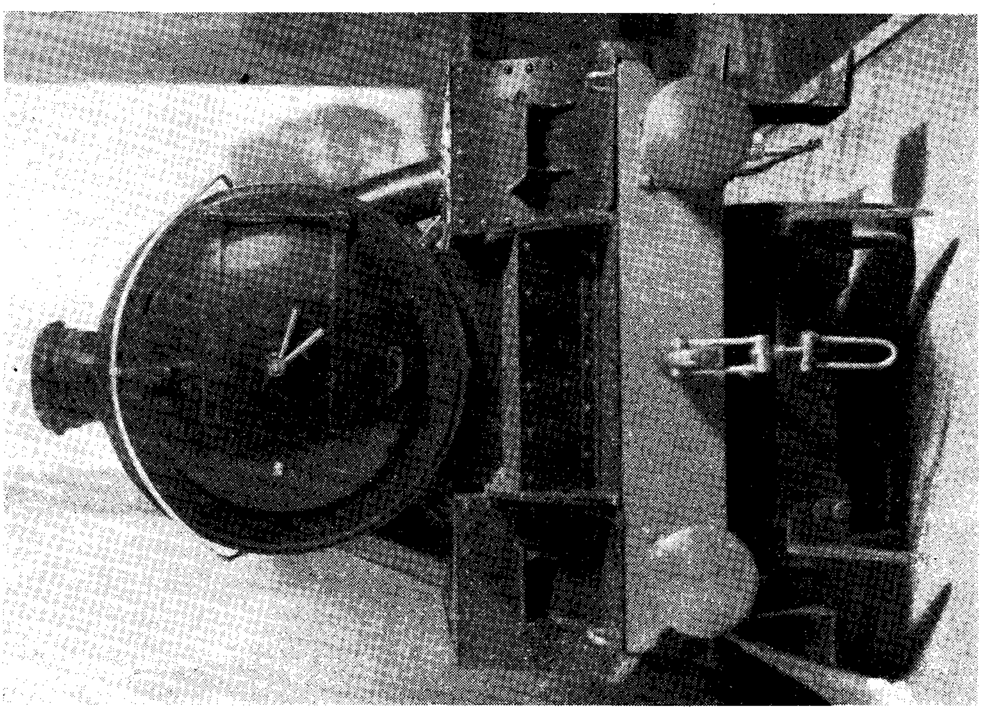
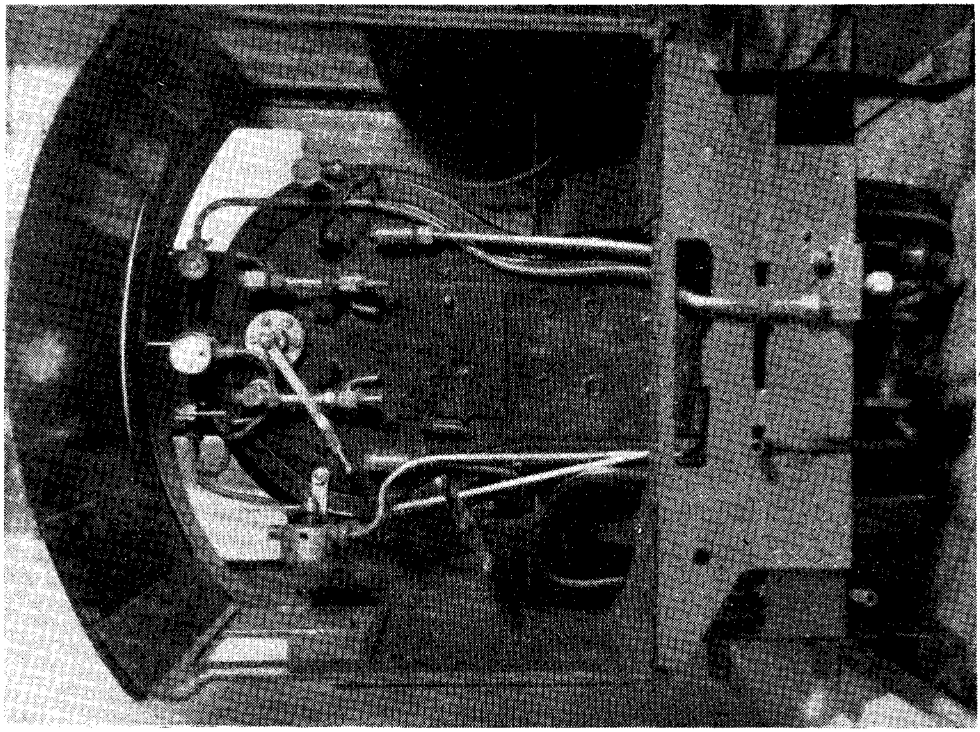


Photo by] [*The Author*

*Bodywork and chassis of tender for the B.*1 *locomotive: the former is built from* 16-*gauge nickel sheet*



Photos by]
An impressive head-on view of Mr. R. Kerry's 1-in. scale model of an L.N.E.R. Class B.1 locomotive



[The Author
Backhead of the B.1; the pipework is temporary only and is to be "cleaned up." Note incomplete driver's brake-valve on left

In workshop equipment, Mr. Kerry is rather better off than many of us. His lathe is a Milnes M-type—that "Rolls-Royce of lathes"—and he has an Atlas milling-machine. His drilling-machine is a Walker-Turner, up to ½-in. capacity, and he has a Norvic shaper, which was hand-operated but which he has converted to power drive. For boiler work, his oxy-coal-gas blowpipe is just the job, with an air-gas blowpipe—supplied by compressor—for smaller work. But, as Mr. Kerry says, and as anyone with experience will confirm, although a well-equipped workshop is a great asset, in the long run it is the work of the *hands* that counts! And although Mr. Kerry is now able to make good use of all these nice machines, he can still remember the days when he had just a small lathe and drilling-machine. That was when, a complete novice, he started to build a 1¼-in. scale traction engine as his first model. This was completed satisfactorily, but not before, as he admits with a chuckle, he had "built enough parts for three complete engines and chucked the parts for two of them in the scrap-box."

Be that as it may, I think the reader will agree that he has learned his lessons well. For my own part, I am confident that when "B.1" is finished she will be a worthy stable-companion to that hardy old warrior, *Atlas*. And one couldn't say fairer than that!

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed: "Queries Dept.," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 9946.—Repairing Boiler Lagging
H.J.R.B. (Cyrenaica)

Q.—While on U.K. leave, I purchased a second-hand model boiler. The boiler is quite a large one, of riveted steel, and is lagged with asbestos. This asbestos is crumbly and appears to have been put on in the form of a paste or pulp, smoothed off and painted. It is beginning to flake off in places and I would like to patch these places up.

(1) How can I repair the places where asbestos is flaking off?
(2) Would a coat of paint form a coating over the whole asbestos surface, and keep it from flaking?
(3) What size steam-pipe do you recommend for an engine 1 in. bore × 1⅝ in. stroke?

R.—(1) The asbestos lagging can be repaired by making up a plaster of broken-up asbestos mill-board with water, and using it to make good any defects, or fill up any holes in the existing lagging. It might possibly be easier to replace the lagging completely by using asbestos mill-board of the required thickness and damp it down to make it sufficiently plastic to mould to the shape of the boiler.

(2) We do not think that a coat of paint will be satisfactory to form a protective coating for preventing the asbestos flaking away. It would be better to fit a complete cleading of sheet metal or wooden battens held in place by bands round the boiler.

(3) A steam pipe of ¼ in. internal diameter should be satisfactory for supplying steam to an engine of the size specified.

No. 9945.—Portable Lathe Drive
F.B. (Arbroath)

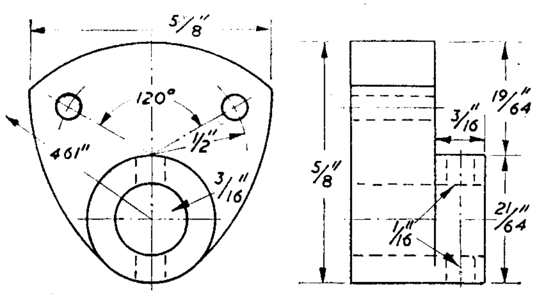
Q.—Can you advise me how to drive a small lathe, which must be entirely portable and fit into a box of about suit-case size. It must be free of the mains, and I had in mind something on the treadle principle.

R.—It would be quite practicable to drive your small lathe by means of a treadle gear, but certain problems would arise in making the outfit sufficiently portable for your purpose. Small foot motors are available on the market, and it might be possible to arrange one of these in such a way that it could be readily attached to the lathe, and form practically a stand, on which the lathe could be erected for use. It might, however, be rather difficult to keep this within the dimensions you state, and another factor which is rather against easy portability is the fact that a fairly heavy treadle flywheel is a necessity. We do not know of anyone who has attempted to make a treadle-driven lathe portable, in the way you suggest, and, therefore, have no information available on the matter.

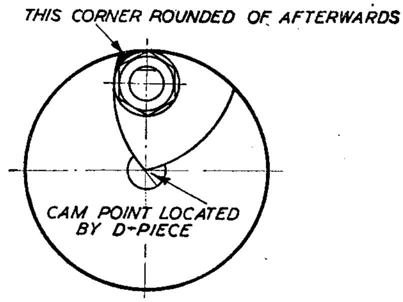
No. 9941.—Machining a Cam
W.B. (Upton-on-Severn)

Q.—I should be obliged if you would advise me if it is practicable to machine a cam for use with the intermittent claw mechanism of a cinematograph, on an Adept lathe.

R.—It should be possible to machine the essential surfaces of this cam on an Adept lathe, and one possible method would be to set out the design and manufacture of rectifiers of the type you have in mind. The process of the special oxide coating of the metal discs or plates is of a secret nature so far as the actual production of this oxide is concerned. In any case, it would not be possible to make oxide-coated discs in an amateur workshop, because special plant is necessary. It is not just a matter of ordinary oxidising of the surface, which in most cases is done by the atmosphere.



CAM BLANK AFTER SECOND FORMING OPERATION



DETAILS OF CAM

centres, from which the various radii are struck, on the end faces of a mandrel which could be used to carry the cam blank. It would then be possible to machine the cam between centres. It is also practicable to machine the cam on the faceplate of the lathe, but in that case rather different means would have to be adopted for locating the exact settings for the turning centres. The cam for the "M.E." cine-projector was described in the issue of THE MODEL ENGINEER dated May 19th, 1938, and the illustration is reproduced here. This design of cam is particularly simple to machine with the aid of a faceplate jig, having a half-round locating-piece and a mounting pin offset by a definitely measured amount from the centre.

No. 9949.—Transformer-rectifier
F.R. (Bristol)

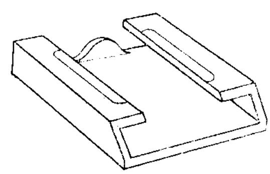
Q.—I am desirous of constructing a transformer-cum-rectifier unit working off a.c. mains 210 V to give up to 24 V d.c. and 10 or 12 A. I can obtain *ex*-W.D. transformers which are for operation on 230 V mains. Each winding is entirely separate from the others electrically.

Would it be possible for a number of these transformers to be connected together to give the desired low voltage prior to a rectifier? I would also welcome information on the design and construction of metal rectifiers, especially the process by which the copper-oxide plates may be produced in the home workshop. Can you recommend a book on the subject?

R.—For transformers to be connected in parallel, they require to be specially matched, and their characteristics must be the same. Small transformers of the same type and manufacture might be capable of parallelling, but this would be a matter for experiment. We know of no publications specially dealing with the

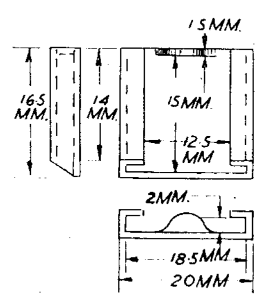
No. 9943.—Accessory Shoe on Cameras
L.C.T. (Aldershot)

Q.—I will be pleased if you can supply me with the dimensions of the attachment slide fitted to such cameras as the Leica and Contax for mounting various view-finders, range-finders, etc. I wish to make such a clip for my own



camera, and would prefer to work to the standard dimensions if possible, rather than produce a design of my own.

R.—We reproduce herewith sketches of the attachment slide, which appears to be of the



standard type, except that, on the Leica camera, the front of the carrier slopes backwards, as can be seen from the first sketch.